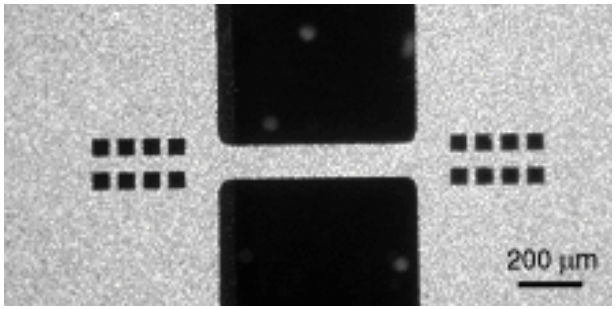
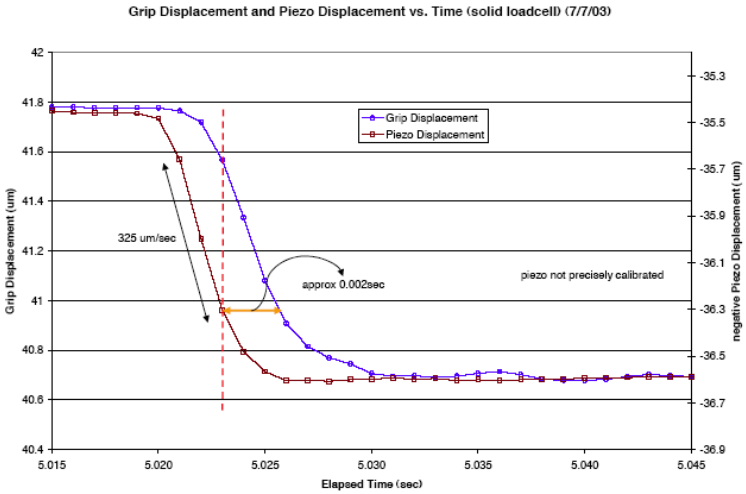
CAREER: Cyclic Plasticity and Fatigue Life of Small-Scale Metal Structures
R.P. Vinci, Lehigh University, DMR-9876261

- Design and fabrication of small-scale metals structures have begun to emerge as areas of increasing interest for MEMS devices.
- We have developed micro-tensile testing techniques suitable for low- (0.5 Hz) and high-cycle fatigue (45 Hz). Prior microtensile testers are only capable of low-cycle testing.
- Fatigue tests of aluminum microbeams are under way.
- We have also developed micro-tensile testing techniques suitable for elevated temperature.
- Elevated temperature stress relaxation tests of gold and gold-vanadium alloy microbeams are under way. Vanadium additions have been shown to reduce stress relaxation.





Above: Plan view of free-standing metal specimen. The squares at either end of the beam are used for optical strain measurement. Below: Data from a conventional load cell demonstrating the spurious "anelastic" response from a 2 msec lag in response time.

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Student Activities:

- 2 graduate students
- 4 undergraduates
- Summer REU student developed lab project for freshman engineers to design and fabricate their own Liquid Crystal Display.

PI Activities:

- 2003 Gilbert E. Doan Award, awarded by graduating Materials Science and Engineering seniors "for service as a mentor".
- 2001-2003 P.C. Rossin Assistant Professor of Materials Science and Engineering
- Member of committee charged with improving the freshman year for all engineering students. Goal: to design a new course that will expose all engineering freshmen to a challenging, meaningful engineering project. Program began running Fall 2003.
- Judge, 2003 Lehigh Valley Science Fair
- Co-organizer, ASME winter symposium 2003, MRS fall symposium 2004.

Top: Prof. Vinci and Lauren Kramer, mechanical engineering undergraduate, installing microtensile tester components that she designed and fabricated.

Bottom: A Liquid Crystal Display, built by undergraduate Andy Prescott, in the "on" state with the letters "NSF" visible.